REMARKS

Favorable consideration and allowance of claims 1-4 are respectfully requested in view of the foregoing amendments and the following remarks.

Claims 1-4 were rejected under 35 U.S.C. § 103 as being obvious over Ishii et al. (US 2002/0038692) in view of Itabashi et al. (US 2002/0129904). Applicants respectfully traverse the rejections as set forth below.

Applicants submit that the prior art fails to teach or suggest all of the limitations of claim 1 of the present application. In particular, the Itabashi et al. reference does not disclose the feature of claim 1 of "a portion of the plasma processing apparatus containing the top plate portion and the antenna portion is configured such that a node of a standing wave formed at the top plate portion and in a space between the top plate portion and the antenna portion is present at a position corresponding to an outer peripheral end of the radial waveguide."

The Itabashi et al. reference describes that a plasma processing apparatus (shown in Fig. 2) is constructed to have a standing wave controlling part in which a quartz plate 301 and a thin air layer (gap) 302 are extended by a portion equivalent to the characteristic length of the standing wave controlling part 106 having been added to the plasma processing apparatus shown in Fig. 1A. *See paragraph [0162].* The Itabashi et al. reference also describes that, in the plasma processing apparatus shown in Fig. 1, the standing wave electric field distribution 110 formed inside the dielectric window will become maximum (i.e.,

assume a maximum amplitude position 111 of the standing wave) at an entrance 108 of the standing wave controlling part. *See paragraph [0154].*

The Itabashi et al. reference further describes that when an electromagnetic wave comes from a dielectric window 103 into a plasma 112, a change in medium serves to inverse a maximum amplitude position and a minimum amplitude position of the standing wave electric field distribution in a location equivalent to inner wall surfaces of a chamber. Accordingly, distribution of standing wave electric field formed in the plasma just below the dielectric window 103 will reach a minimum (i.e., assume a minimum amplitude position of the standing wave) in the location equivalent to the inner wall surfaces of the chamber, so that stable and continuous plasma production characteristic can be obtained. *See paragraphs [0155] and [0156].* Note that the "minimum amplitude position" and the "maximum amplitude position" in the Itabashi et al. reference correspond to the "node" and the "antinode," respectively, described in the present application.

In other words, in the Itabashi et al. reference, the dimension of the dielectric window 103 is set such that the standing wave formed at the dielectric window has an antinode (reference number 111) at a position corresponding to the inner wall surface of the chamber (process chamber 305) at the dielectric window 103 (i.e., $d=\lambda/4 + \lambda/2 \bullet (n-1)$) (see "A" on the attached sheet, which illustrates FIGS. 1A, 1B, 2, 3A, 3B and 3C of Itabashi et al.).

By contrast, in the invention recited in claim 1, the dimension of the portion containing the top plate portion and the antenna portion and the dimension of the radial waveguide in the antenna portion are set such that these dimensions satisfy the relational expression recited in claim 1 (i.e., (B-A)2 = $\lambda_g/2 \bullet N$). The standing wave has a node at an end portion (outer peripheral end) of a region where the standing wave itself is formed. Therefore, the standing wave formed at the top plate portion and in the space thereabove has a node at a position Q corresponding to the outer peripheral end of the radial waveguide, according to the relevant relational expression (see "B" on the attached sheet, which illustrates FIG. 3 of the present application).

In the Itabashi et al. reference, however, an expression that describes "d" includes $\lambda/4$ (i.e., $d = (\lambda/4) + (\lambda/2)(n-1)$), and hence the standing wave has an antinode at the entrance 108.

In a plasma processing apparatus, a plasma production region within a chamber is maintained by the mutual coupling of the first standing wave generated in the radial waveguide and the second standing wave generated at the top plate portion and others, and if their mutual coupling is weak, there is a tendency that the second standing wave predominantly contributes to maintenance of the plasma production region. However, the second standing wave is liable to vary depending on process conditions such as a pressure in a chamber. Therefore, if the second standing wave varies, it is difficult to control the electromagnetic field, which forms the plasma production region, and hence

there arises a problem of variations in etching rate and film deposition rate. *See the "Background Art" section of the specification.*

The apparatus claimed in claim 1 of the present application overcomes such problems. By satisfying the relational expression recited in claim 1, it is possible to achieve strong coupling between the first standing wave and the second standing wave, and stabilize the process in the plasma production region.

The Itabashi et al. reference fails to describe the relationship between the antenna portion (radial waveguide) corresponding to the region where the first standing wave is formed, and the dielectric window (top plate portion) corresponding to the region where the second standing wave is formed. In the present application, the inner diameter C of the chamber and the inner diameter A of the radial waveguide satisfy the relationship recited in claim 2. For example, assuming that the inner diameter C of the chamber is substantially equal to the inner diameter A of the radial waveguide, the second standing wave has a node at the position of the inner surface of the chamber. Therefore, the standing wave formed at the top plate portion, etc., in the invention of the present application is different from that of the Itabashi et al. reference, which has an antinode at the inner surface of the chamber.

Accordingly, claim 1 of the present application differs from the plasma processing apparatus in the Itabashi et al. reference in its configuration because, as to the second standing wave, its antinode is not always present at the position of the inner surface of the chamber.

Additionally, Ishii fails to make up for the above-described deficiencies of the Itabashi et al. reference.

Therefore, claim 1 and its dependent claims 2-4 are patentable over the prior art.

In view of the foregoing, Applicants submit that the application is in condition for allowance and such action is earnestly solicited.

If there are any questions regarding this response or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket # 101248.55500US).

Respectfully submitted,

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Attached sheet

A

FIG. 1A

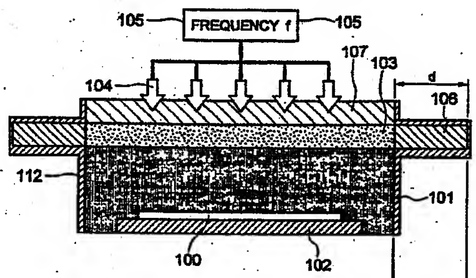
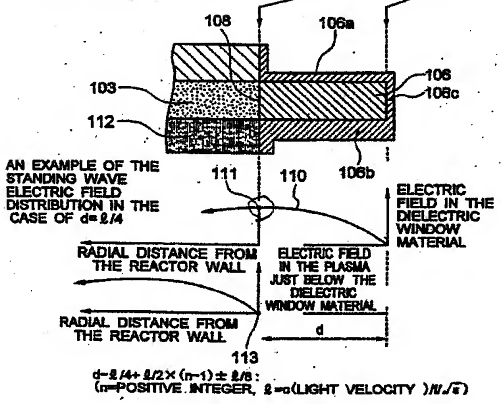
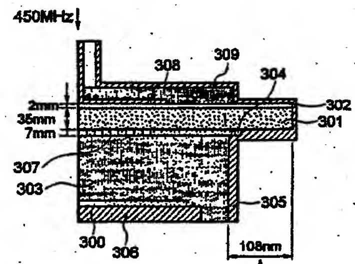


FIG. 1B



$$d=\frac{\lambda}{4}+\frac{\lambda}{2}(n-1)$$

FIG. 2

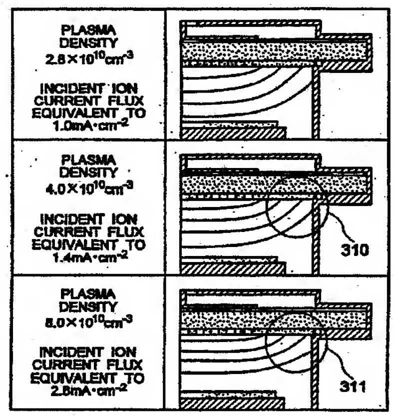


d

FIG. 3A

FIG. 3B

FIG. 3C



B

$$\frac{B-A}{2}=\frac{\lambda}{2}\cdot N$$

FIG.3